Abstract:

The sunflower conjecture is a famous open problem in combinatorics, asked by Erdos and Rado in 1960. A sunflower is a collection of sets with the same pairwise intersection pattern. The conjecture asks if given a large enough family of sets, it must contain a sunflower. Erdos and Rado proved that this is indeed true, but they conjectured that the quantitative bounds that they showed can be improved. In the last 60 years, many applications of sunflowers were found (both in math and in CS), but the original bounds were not significantly improved. Two years ago, we were able to significantly improve the quantitative bounds, getting much closer to the conjectured bound. Perhaps surprisingly, our new techniques draw inspiration from computational complexity, concretely from the Hastad switching lemma. The switching lemma states that any DNF formula simplifies if most of its inputs are fixed to random values. We show that if the DNF is pseudo-random, then in fact it suffices to restrict only a small fraction of the inputs. I will explain this result and how it is connected to the study of the sunflower conjecture. No background knowledge is assumed. Based on joint work with Ryan Alweiss, Kewen Wu and Jiapeng Zhang.